REMARKS

By the present amendment, claims 1 to 3 are pending in the application. Claim 1 is the only independent claim.

Support For Claim Amendment

In amended claim 1, support for the addition of the claim limitation -- composed of a two-phase structure of ferrite and bainite-- may be found in canceled dependent claim 4 and the specification at page 6, lines 25-27.

Dependent claim 4 was part of elected Group I, i.e., claims 1 to 4 directed to a steel sheet.

Restriction Requirement

In response to the restriction requirement, applicants affirm the election of the claims of Group I, i.e., claims 1 to 4 directed to a steel sheet.

By the present amendment, non-elected method claims 5 and 6 have been canceled without prejudice to the filing of a divisional patent application directed to the subject matter of canceled claims 5 and 6.

§102/§103

Claims 1 and 3 were rejected under 35 U.S.C. §102(b) as being anticipated by CN 1,251,140 ("CN '140").

Claim 2 was rejected under 35 U.S.C. §103(a) as being unpatentable over CN 1,251,140 ("CN '140").

Claims 1 to 4 were rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 6,589,369 ("US '369") or Japan No. 2002-129285 ("JP '285").

These rejections, as applied to the amended claims, are respectfully traversed.

The Present Invention

A characteristic feature of the present invention is as follows. In a high strength hot rolled steel sheet, hole expandability (burring) and elongation properties exhibit quite an opposite tendency. The present inventors solved this problem by means of ferrite grain size having more than the predetermined size in a ferrite-bainite steel for improving elongation without deterioration of hole expandability (burring).

The present invention is a steel with a substantially two-phase structure of ferrite and bainite where the ferrite improves the elongation and precipitates comprised of TiC, NbC and VC secure the strength and cause sufficient growth of the ferrite grains to improve the elongation without lowering the burring, and then causes the formation of precipitates to secure the strength so as to thereby solve the above problems. That is, the present inventors discovered that by obtaining a specific microstructure of the present inventive steel sheet comprising a low C-low Si-high Al-(Ti, Nb, V) system and having Mn and Al in a specific relationship, the high strength hot rolled steel sheet simultaneously satisfying the three characteristics of burring, elongation, and the ability of the phosphate coating is obtained. See specification, pages 6 and 7.

Further, it is important to satisfy the specific relationship between Mn and Al defined in equation (1) of claim 1 for simultaneously satisfying both elongation and the ability of the phosphate coating.

Fig. 1 of the drawings of the present application shows the relationship between Al and Mn, In Fig. 1, the horizontal line at 2.0 wt% Al is the maximum Al

according to the present invention as set forth in claim 1. The vertical line at 3.5 wt% Mn is the maximum Mn. The line at an angle is the "4" of the equation Mn + 0.5 x Al < 4, i.e., equation (1) of claim 1. The Si content of the steel of Fig. 1 is 0.5% or less. See specification at page 8, lines 24-28. The "O" in Fig. 1 means the ability of the phosphate coating is good, i.e., the phosphate coating is not damaged. The "X" in Fig. 1 means the ability of the phosphate coating is poor.

Mn must be limited to 0.50 - 3.5% because if the Mn content exceeds this amount there is a deterioration in the ability of phosphate coating (page 7, lines 25-32). Al is also limited to 0.15 - 2.0% because Al in an amount of 0.15% or more improves the elongation without damaging the ability of phosphate coating, and Al in an amount of not over 2.0% achieves both elongation and the ability of phosphate coating (page 8, lines 1-20). For the achievement of both elongation and ability of phosphate coating, it is also important to define the relationship between Mn and Al. Under the condition of Mn + 0.5 x Al < 4, the ability of phosphate coating is not damaged without deterioration of burring (page 8, lines 21-28).

Patentability

CN 1,251,140 was not applied to reject dependent claim 4. Since amended independent claim 1 contains the limitations of dependent claim 4, it is submitted that the rejection over CN 1,251,140 is now moot.

The technology disclosed in CN 1,251,140 relates to a dual-phase high strength steel sheet having excellent dynamic deformation properties used in structural members and reinforcements of automobiles having a microstructure comprising a composite texture ferrite and low-temperature formed phase of martensite of 3 - 50%.

Therefore, the present invention is quite different from the technology disclosed or suggested in CN 1,251,140 in the point of the metallic structure.

The technology disclosed in USP 6,589,369 relates to a high fatigue strength steel sheet excellent in burring workability, which contains a similar steel composition to the present invention steel sheet except for Al.

The Al content of the Example P of US '369 referred to in the Office Action contains Al: 0.026% which is very different from amount of Al in the present inventive steel. Regarding the coiling temperature, US '369 discloses that the coiling temperature has to be 350°C or below when producing a steel sheet whose microstructure is a compound structure having ferrite as the main phase and martensite as the second phase.
The reason for this is that, if the coiling temperature is above 350°C, bainite forms and martensite does not form in a sufficient amount, and thus the desired microstructure of US '369 having ferrite as the main phase and martensite as the second phase is not obtained. Therefore, the coiling temperature has to be 350°C or below (column 12, lines 45-54). In Example P, the steel sheet is coiled at 50°C, and the resultant steel sheet contains an amount of martensite in the second phase which is 6% without containing bainite.

Although Comparative Examples in USP 6,589,369 show steels containing a ferrite and bainite structure, Steel C in Tables 3 and 4 contains Si: 1.62% and Al: 0.026% and thus deteriorate of the ability of phosphate coating. Further, Steel F in Tables 3 and 4 contains Si: 0.78% and Al: 0.019% and thus deteriorates the ability of phosphate coating

Therefore, the technology disclosed or suggested in US '369 is very different from the present inventive steel in the points of Al concentration and the kind of steel microstructure.

The technology disclosed in JP2002-129285 relates to a steel sheet with strain induced transformation type composite structure having excellent burring workability which contains a similar steel composition. However, in Example M, Si: 1.4% and Al: 0.044% are both far outside the range of the present invention. The steel sheet of JP '285 deteriorates the ability of the phosphate coating because of low Al and high Si contents. This Example M is similar to the Comparative Example 5 in Table 1 - 2 at page 19 of the specification which contains Si: 1.2% and Al: 0.04%, and exhibits deterioration of the ability of phosphate coating. Although, in JP2002-129285, the Comparative Example has ferrite-bainite structure which contains C: 0.1%, Si: 1.36%, Al: 0.32%. This Si content is far outside the range of the present invention which requires 0.50% or less Si. Thus, this Comparative Example steel of JP '285 exhibits deterioration of the ability of phosphate coating.

Therefore, the technology disclosed or suggested in JP2002-129285 is very different from the present invention.

None of the cited references disclose or suggest an improvement of the ability of phosphate coating in addition to satisfying the characteristics of excellent burring and excellent elongation.

It is therefore submitted that amended claim 1, and claims 2 and 3 dependent thereon, are patentable over CN 1,251,140 and/or U.S. Patent No. 6,589,369 and/or Japan No. 2002-129285, alone or in any combination.

INFORMATION DISCLOSURE STATEMENT

Enclosed herewith is an Information Disclosure Statement which resubmits the foreign patent documents listed on Form PTO-1449 of the Information Disclosure

Statement filed April 4, 2006 (Certificate of Mailing dated March 29, 2006). These foreign patent documents were cited in a European Search Report in a counterpart European patent application.

CONCLUSION

It is submitted that in view of the present amendment and foregoing remarks, the application is now in condition for allowance. It is therefore respectfully requested that the application, as amended, be allowed and passed for issue.

Respectfully submitted,

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